Dhirubhai Ambani Institute of Information and Communication Technology

M.Tech (ECE)

Sample Question Paper

1. If a fair dice is rolled twice, what is the probability that an odd number follows an even number?

   (a) 0.25
   (b) 0.5
   (c) 0.75
   (d) 1

2. The probability density function of a random variable X is given by:

   $$f_X(x)=\begin{cases} k & a \leq x \leq b \\ 0 & \text{otherwise} \end{cases}$$
   where k is constant. If a = -1 and b=2, then $P(|x| <= c)$ for $c = \frac{1}{2}$ is

   (a) $\frac{1}{4}$

   (b) $\frac{1}{3}$

   (c) $\frac{1}{2}$

   (d) $\frac{3}{4}$

3. A car manufacturing company has two plants A and B. Plant A manufactures 60 percent of the cars and plant B manufactures 40 percent of the cars. 80 percent of the cars at plant A and 90 percent of the cars at plant B are rated of standard quality. A car is chosen at random and is found to be of standard quality. What is the probability that it is manufactured at plant A?

   (a) 2/7
   (b) 4/7
   (c) 3/7
   (d) 1/7

4. The number of observations smaller than _____ is the same as the number of observations larger than it.

   1. Median
   2. Mode
   3. Mean
   4. None of the above

5. Consider a differential equation $\frac{d^2y}{dx^2} = -4y$. When x=0, then y=5 and $\frac{dy}{dx} = 0$. The expression of y is

   (a) $y = 4\sin(5x)$
   (b) $y = 10x$
   (c) $y = 5\cos(2x)$
   (d) $y = 2\sin(5x) + 5\cos(2x)$

6. Which of the following is correct for Digital Circuits?

   a) Less susceptible to noise or degradation in quality
   b) Use transistors to create logic gates to perform Boolean logic
   c) Easier to perform error detection and correction with digital signal
   d) All of the mentioned

7. Which of these flip – flops cannot be used to construct a serial shift register?

   a) D – flip flop
   b) SR flip – flop
   c) T flip – flop
   d) JK flip – flop

8. Which of the following statement is incorrect?

   a) Output of CE amplifier is out of phase with respect to its input
   b) CC amplifier is a voltage buffer
   c) CB amplifier is a voltage buffer
   d) CE amplifier is used as an audio (low frequency) amplifier

9. At 3dB cut-off frequency the voltage gain will be _____

    a) 100% of maximum gain
    b) 70.7% of maximum gain
   c) 80.7% of maximum gain
    d) 47.5% of maximum gain

10. AC resistance of a diode was found to be r_1 and r_2, when measured with two different values of diode current i.e. 10 mA and 25 mA respectively, for the same diode voltage. Which of the following options hold true?

    a) $r_1 = r_2$
    b) $r_1 > r_2$
    c) $r_1 < r_2$
    d) Can't be determined

11. Steady-state value *of* $F(s) = \dfrac{k}{s+a}$ for step input P
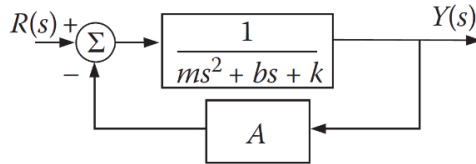
    (a) $\dfrac{kP}{a}$
    (b) $\dfrac{P}{a}$
    (c) $\dfrac{k}{a}$
    (d) $\dfrac{k+P}{a}$

12. Assume $b = 2$, $k = 4$ and all initial conditions are zero for the system depicted in below Figure. The equation of motion when a step force of F is applied at $t = 0$ is,
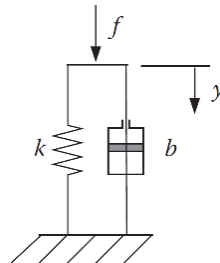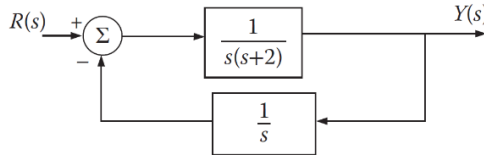

    (a) $\dfrac{F}{8}$
    (b) $\dfrac{F}{2}$
    (c) $\dfrac{F}{3}$
    (d) $\dfrac{F}{4}$

13. A camera reads the position of a mass-spring-damper system and feeds it back to the input-force system. The closed-loop transfer function for this system is,

R(s) + (Σ) → [$\frac{1}{ms^2 + bs + k}$] → Y(s)

[A]

(a) $\frac{1}{ms^2 + bs + (k+A)}$

(b) $\frac{1}{ms^2 + bs + k}$

(c) $\frac{1}{ms^2 + bs + k/A}$

(d) $\frac{1}{ms^2 + bs + k.A}$

14. The closed-loop transfer function for the system is,

R(s) + (Σ) → [$\frac{1}{s(s+2)}$] → Y(s)

[$\frac{1}{s}$]

(a) $\frac{s}{1+ s^2(s+2)}$

(b) $\frac{1}{1+ s^2(s+2)}$

(c) $\frac{s}{s^2 + s + 2}$

(d) $\frac{1}{s^2 + 2s + 2}$

15. A bar of Gallium Arsenide (GaAs) is doped with Silicon such that the Silicon atoms occupy Gallium and Arsenic sites in the GaAs crystal. Which one of the following statement is true?

   (a) Silicon atoms act as p-type dopants in Arsenic sites and n-type dopants in Gallium sites

   (b) Silicon atoms act as n-type dopants in Arsenic sites and p-type dopants in Gallium sites

   (c) Silicon atoms act as p-type dopants in Arsenic as well as Gallium sites

   (d) Silicon atoms act as n-type dopants in Arsenic as well as Gallium sites

16. Which of the following is Not associated with a p-n junction?

    (a) Junction Capacitance
    (b) Charge Storage Capacitance
   (c) Depletion Capacitance
    (d) Channel Length Modulation

17. The phase velocity of waves propagating in a hollow metal waveguide is

    (a) Greater than the velocity of light in free space
    (b) less than the velocity of light in free space
    (c) Equal to the velocity of light in free space
    (d) Equal to the group velocity

18. A two wire transmission line terminates in a television set. The VSWR measured on the line is 5.8. The percentage of power that is reflected from the television set is

    (a) 48.9
    (b) 84.9
    (c) 49.8
    (d) 94.8

19. The current I (in Ampere) through the 8Ω resistance as shown in the figure below is
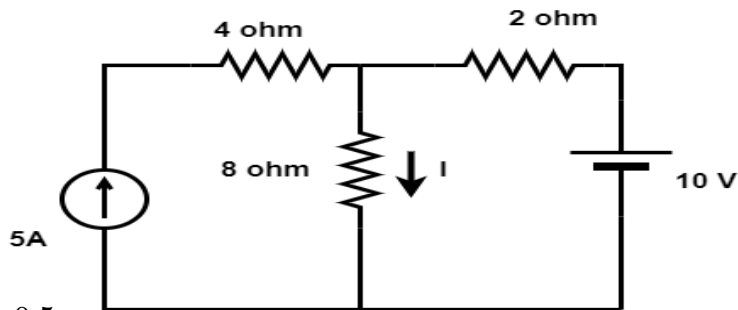
    (a) 0.5
    (b) 1.0
    (c) 2.0
    (d) 3.0

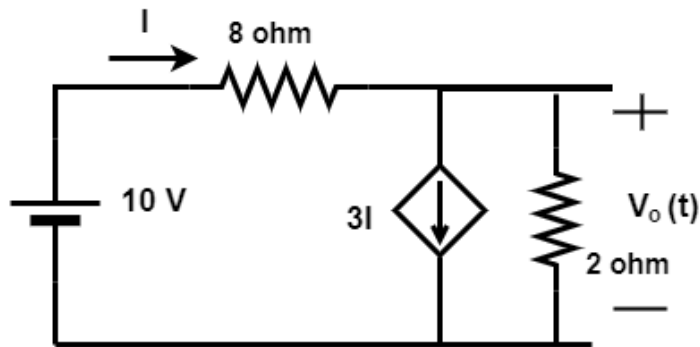20. Y -parameters of the T-network with all the elements having equal resistance of $1/3\Omega$ are

(a) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

(b) $\begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$
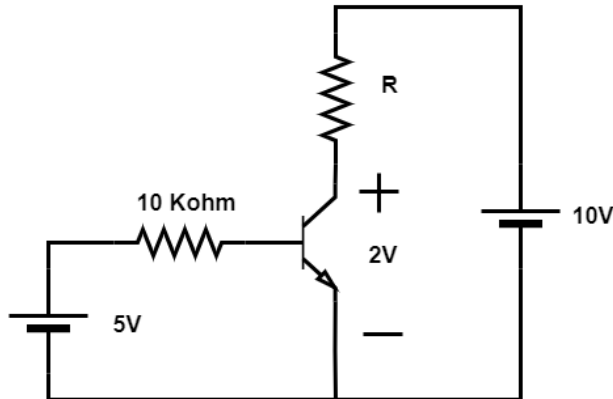
(c) $\begin{bmatrix} 1 & -3 \\ -1 & 4 \end{bmatrix}$

(d) $\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$

21. The output voltage $V_o(t)$ in the following circuit is

(a) 2 V
(b) 20 V
(c) -10 V
(d) 4 V

22. In the circuit shown below, the voltage across collector and emitter is $V_{CE} = 2$ V. For the transistor , consider $V_{BE} = 0.7$ V and $\beta = 100$. The resistance R is

(a) 10 Kohm
(b) 1 Kohm
(c) 246 ohm
(d) 186 ohm

23. In amplifier circuit, voltage series feedback

(a) increases both the input and output resistances
(b) decreases both the input and output resistances
(c) increases input resistance but decreases output resistance
(d) decreases input resistance but increases output resistance

24. x(t) and y(t) are the input and output of a system, respectively. From the following which one is non-linear system

(a) $y(t) = 2x(t) + 5$
(b) $y(t) = t^2 x(t)$
(c) $y(t) = x(t^2)$
(d) $y(t) = sin(2t)x(t)$

25. A signal is defined by $f(t) = cos^2(4\pi t) - 3\sin(8\pi t) - 0.5$. The signal $f(t)$ has following frequencies:

   (a) DC and 4Hz only
   (b) 4Hz and 8Hz only
   (c) 4Hz only
   (d) DC and 12Hz only.

26. The Fourier Series of an odd periodic function, contains only
   (a) cosine terms
   (b) sine terms
   (c) odd harmonics
   (d) even harmonics

27. If a signal x(t) has energy E, the energy of the signal x(t/4) is equal to

   (a) E
   (b) E/4
   (c) 4E
   (d) E/2

28. Consider the signal $f(t) = cos^3(4\pi t) - 2\sin(8\pi t)$ where t is in seconds. The Nyquist sampling rate (in samples/second) for the signal

   (a) 12
   (b) 8
   (c) 4
   (d) 8

29. A modulated signal is given by, $y(t) = (2 + m_1(t))\cos(2\pi f_c t) + (1 + m_2(t))\sin(2\pi f_c t)$ where the baseband signal $m_1(t)$ and $m_2(t)$ have bandwidths of 20 kHz and 35 kHz, respectively. The bandwidth of the modulated signal, in kHz, is

   (a) 40
   (b) 35
   (c) 55
   (d) 70

30. A modulated signal $y(t) = \cos(2000\pi t) - 0.1\cos(10\pi t)\sin(2000\pi t)$ represents

    (a) DSBSC
    (b) Narrow Band FM
    (c) SSB
    (d) AM